SGE: it means?

> **In French:** **Système de gestion Énergétique**
pour les bâtiments CI

> **In English:** **Energy Management system**
for CI buildings

> **Project goal**

increase energy efficiency in Commercial and Institutional Buildings

using information provided by BAS

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Proceedings of the 13th International Conference for Enhanced Building Operations, Montreal, Quebec, October 8-11, 2013

Why SGE software is needed?

> Increase energy efficiency in Commercial and Institutional Buildings

> Optimize HVAC systems operation (Power demand and energy consumption)

> Simplify and assist building operators

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What is the context?

> 10 to 30 % of energy waste due to improper use of the automated control

> Availability of information and measurements by BAS systems

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What is SGE software?

- > Energy information system
- > Simplified installation and usage
- > Free product for CI Hydro-Quebec customers
- > Partnership between Hydro-Quebec and Regulvar
- > Collaboration with LBNL for model calibration

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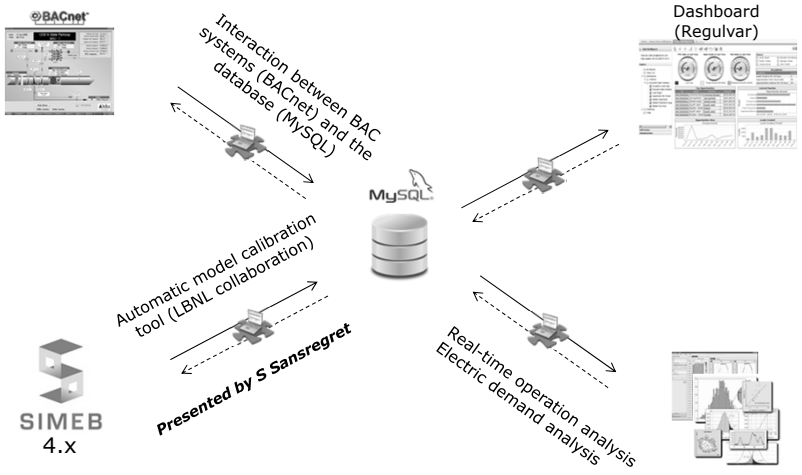
What is SGE software?



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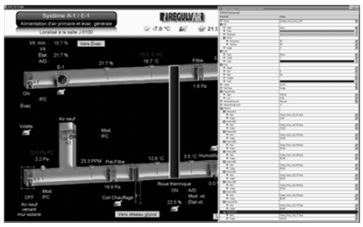
Interaction between BAC systems (BACnet) and the database (MySQL)

System Mapping (Existing buildings)



Syst_A1-E1.gpc	Evacuateurs.gpc
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Syst_E6-E7.gpc	Evacuateurs.gpc
Syst_A1-E1.gpc	ResEau_ResGly2.gpc
Syst_A1-E1.gpc	ResEau_ResGly2.gpc
Syst_A1-E1.gpc	ResEau_ResGly2.gpc
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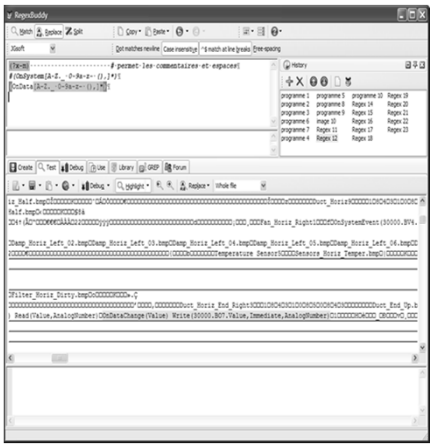
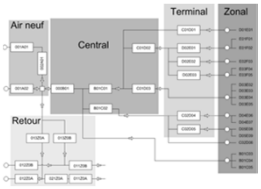


Interaction between BAC systems (BACnet) and the database (MySQL)

- **Semi-automatic mapping of HVAC equipments and control devices**
- **New naming convention developed for SGE software**



- **Storing control data in a structured database : suitable to do energy calculations and analysis**

Dashboard : Real-time operation analysis

> Real-time operation analysis

- Based on the calculations of operation and performance indicators
- Expert analysis of indicators for a global behavior of HVAC system real-time operation
- Convivial presentation for building operators

> Electric demand analysis

- Based on 15min electric consumption
- Using PRISM algorithm to analyze the daily electric consumption vs. daily mean temperature
- Using Fuzzy clustering to identify reference daily electric demand profile (compare with actual profile)
- Both methods requires a minimum of 1 year of historical data

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Dashboard : Real-time operation analysis

> What are operation indicators?

- Value calculated from combination of measurements, set points or others operation indicators
- Comparables values with power units or no unit
- 30 fixed defined indicators for all types of systems what makes them comparable

Example:

Total heat produced in the HVAC central system ***Qhcents***

Total heat produced in the HVAC terminal system ***Qhterms***

Total cool produced in the HVAC terminal system ***Qcterms***

Number of zones with heating demand ***Nh***

Value of maximum terminal heating system intensity ***Ihterms***

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Dashboard : Real-time operation analysis

> What are performance indicators?

- Indicate good or improper operation of the HVAC system
- Three possible values: 1 – green (good operation), 2 – yellow (possible fault detected), 3 – red (real operation problem)
- Determined by comparison between operation indicators, comparison between operation indicators and system data

Example

Simultaneous heating and cooling: central vs. terminal

Qhcents > 0

- **. If Qcterms = 0 then Performance Indicator is GREEN**
- **. If Qcterms < 0 and Ihterms = 1 then Performance Indicator is YELLOW**
- **. If Qcterms < 0 and Ihterms < 1 then Performance Indicator is RED**

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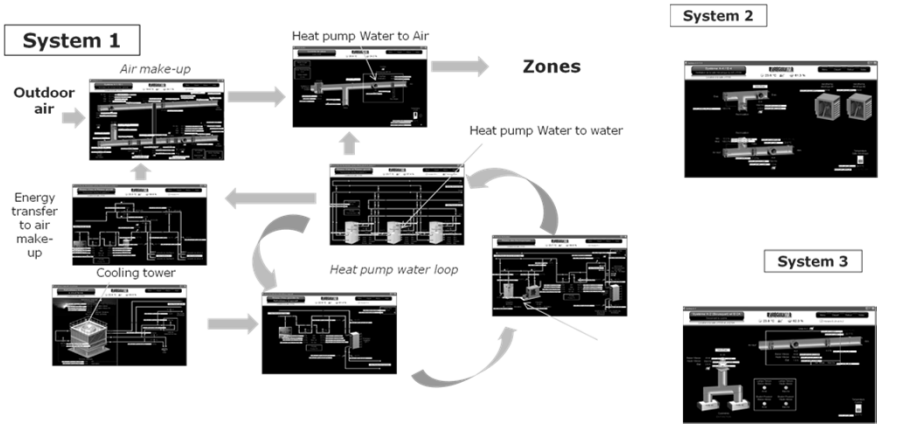
Dashboard : Real-time operation analysis -> Case study



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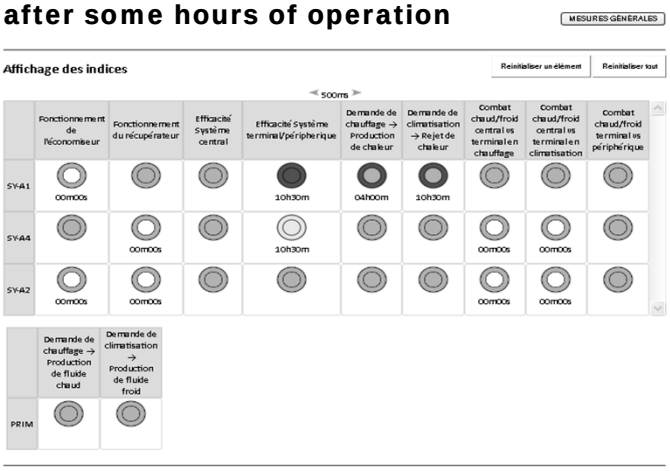
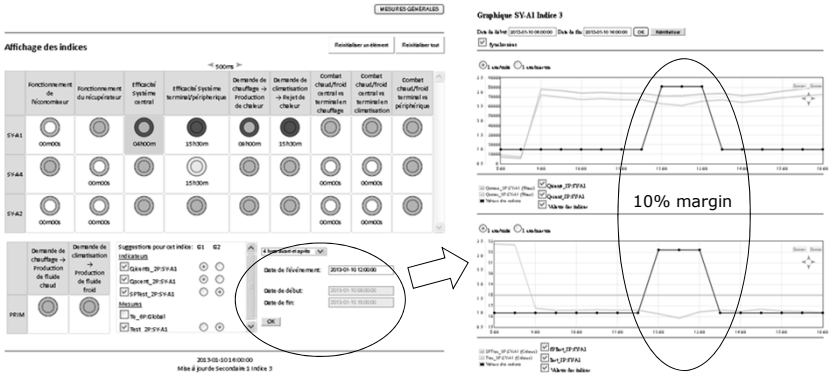
Dashboard : Real-time operation analysis -> Case study

View after some hours of operation



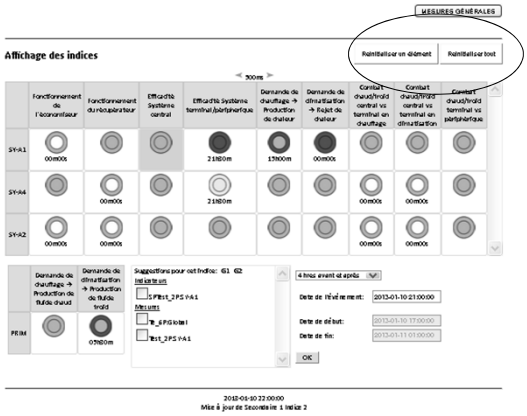
Dashboard : Real-time operation analysis -> Case study

Performance indicator #3



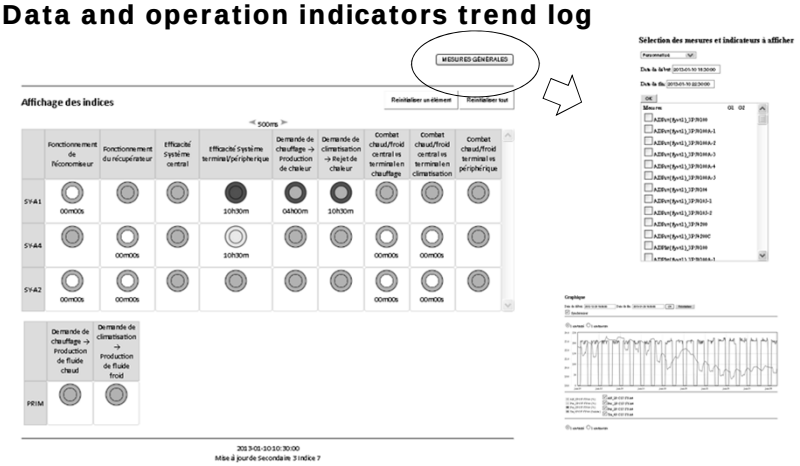
Dashboard : Real-time operation analysis -> Case study

Performance indicator #3 after initialization

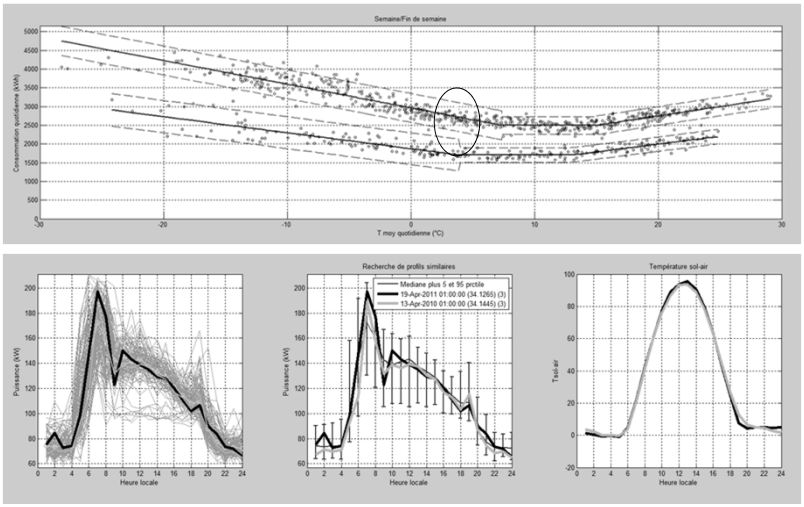


Dashboard : Real-time operation analysis -> Case study

Data and operation indicators trend log



Dashboard : Electric demand analysis -> Case study



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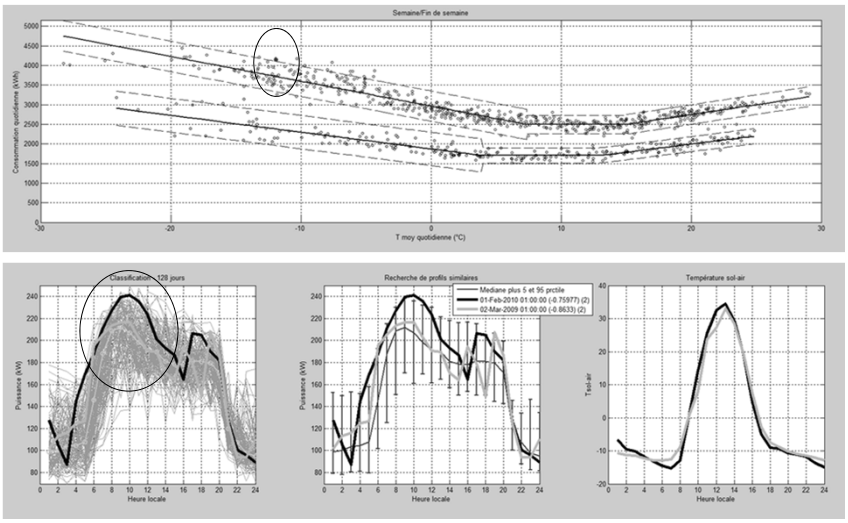
Dashboard : Electric demand analysis -> Case study



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Future developments

- > Improving automatic mapping of the HVAC system
- > Improvement of UI with Regulvar collaboration
- > Including HVAC system component efficiency analysis
- > Using calibrated model to optimize HVAC system operation

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